



Low-Cost, High-Quality LED Product Manufacturing

Examining Challenges and Opportunities Throughout the Supply Chain



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What Do the Customers Expect from SSL Solutions

- **Sustained and Consistent Illumination Performance**
 - Little or No Maintenance Required Throughout the Expected Service Life of the Product



- **Predictable Economic Performance**
 - High Reliability / Low Risk Illumination Performance Throughout the Installed Life of the Product

General SSL Opportunities

- **The Ability to Address Illumination Challenges in More Ways Than Before**
 - **More Products and More Product Configurations**
 - Illumination performance Optimizing
 - Economic Fine Tuning

Optimized Balance = Lowest Total Cost
of Ownership



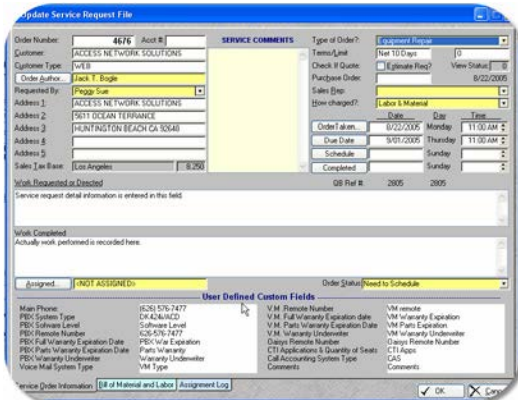
Resulting Manufacturing Challenges

- **Avoiding Heavier/Expensive Inventory**
 - Keeping Inventory in Lowest Common Denominator Form
 - No Sub-Assemblies or Finished Goods Inventory



Resulting Manufacturing Challenges

- Requires Expeditious Order Processing and Product Build
 - More Robust Enterprise Resource Planning
 - Reducing Lead Times
 - Increased Order-to-Cash Velocity



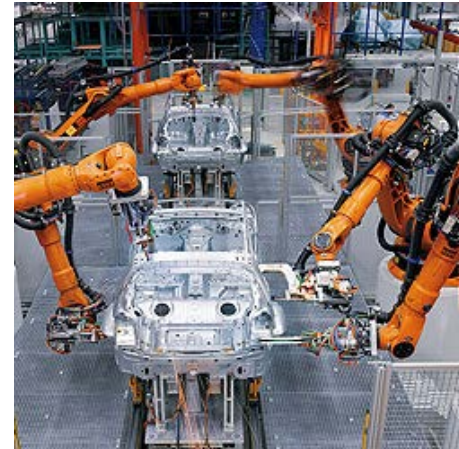
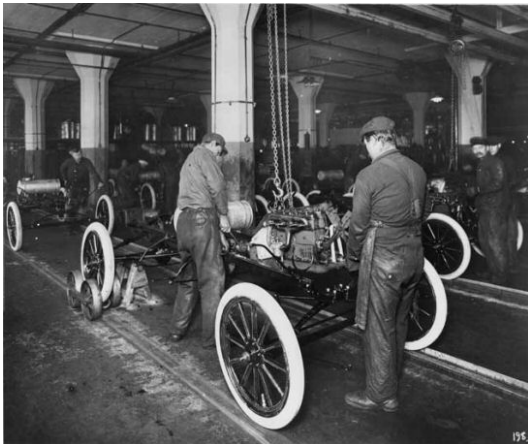
Resulting Manufacturing Challenges

- **Requires Optimized Manufacturing Space Utilization**
 - Low Manufacturing Space to Throughput Ratio
 - Flexible Manufacturing Technologies
 - Supports Rapid Innovation
 - Supports a “Future Proof” Manufacturing Philosophy



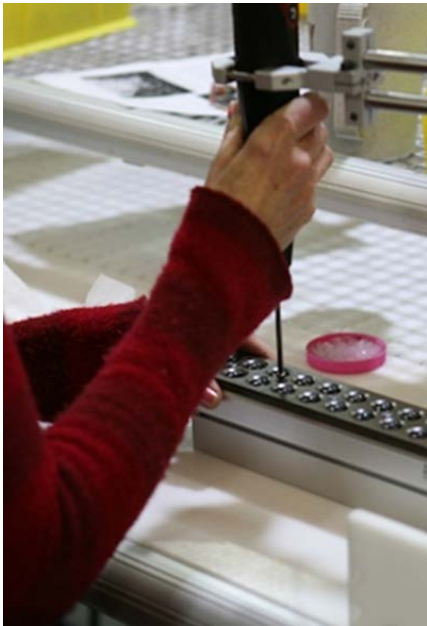
Is More Automation the Answer?

- **Speed and Accuracy**
 - Predictability
 - Quality Assurance
- **Specialized Automation vs. Flexible Automation**
 - Avoid Automation Investments that Confine Innovation Potential and Product Lifecycle Management
 - Product Lifecycles Will Be Shorter by Comparison
 - Industry Wide Innovation Will Occur at an Accelerated Rate



Is More Automation the Answer?

- DFMA for Low Cost or No Automation Requirements?
 - Simplified Full Mechanical Assemblies
 - Avoid Processes Cure Times, Heating, etc...



Managing Manufacturing Process Risks

“In-Process” Performance and Quality Validation

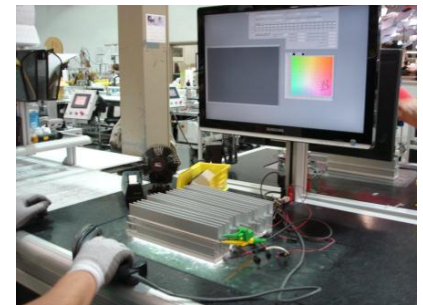
Goals

- Verify and Document Performance Metrics as Part of the Manufacturing Process
- Identify conditions that may lead to performance compromises or failures



Examples:

- Leak Testing
 - Photometric Testing (Color and Absolute Intensity)
 - General Mechanical Integrity Testing
 - Etc.
-
- Done With No Compromises In Assembly Time
 - Data Tied to / Embedded in the Luminaire Serial Number



Can US Manufacturing Be Globally Competitive?

- **Potential Risks of Offshore Manufacturing**
 - Transportation Risks
 - Dynamic Workforce
 - Quality Control Challenges
 - Tariffs
 - Economic Uncertainty...



Can US Manufacturing Be Globally Competitive?

- **Potential Opportunities for US Manufacturing**
 - **Global Products (compared to incumbents)**
 - Universal electrical compatibility (not locally defined)
 - Broad compliance possibilities
 - **Workforce Stability Through Investment in Employees**
 - Evolving Technology
 - Growth Industry
 - Very Low Market Penetration
 - **Availability of Natural Resources and Manufacturing Technologies**





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